Three-way cable interlock kit for Magnum fixed circuit breaker (Type 31 and 33 interlock)

⚠️ WARNING

1) ONLY QUALIFIED ELECTRICAL PERSONNEL SHOULD BE PERMITTED TO WORK ON THE EQUIPMENT.
2) ALWAYS DE-ENERGIZE PRIMARY AND SECONDARY CIRCUITS IF A CIRCUIT BREAKER CANNOT BE REMOVED TO A SAFE WORK LOCATION.
3) ALL CIRCUIT BREAKERS SHOULD BE SWITCHED TO THE OFF POSITION AND MECHANISM SPRINGS DISCHARGED.

FAILURE TO FOLLOW THESE STEPS FOR ALL PROCEDURES DESCRIBED IN THIS INSTRUCTION LEAFLET COULD RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE.

Section 1: General information

A family of mechanical interlocks is available to interlock the closing of two or three Magnum circuit breakers. The mechanical interlock holds one or more circuit breakers tripped (prevents closure) when others are closed. A lever assembly is mounted on each breaker that interfaces with the pole shaft and the tripper bar. The lever assemblies are interconnected with cables. Cables can be used for any orientation of the breakers.

Required tools

- 10 mm socket and 1/4-inch drive socket
- 10 mm open end wrench
- 11/16-inch open end wrench
- 3/8-inch open end wrench
- 0.5 mm feeler gauge
- 4 mm Allen wrench
- Drive extension

Kit parts identification

Refer to Figure 1 and Figure 2 for visual identification of the parts listed below for the different kits:

Kit 1 (shown in Figure 1): Interlock kit parts to mount to breaker; does not include the cable.

(A) M6 x 12 mm hex bolt (12)
(B) M6 x 25 mm flat-head screw (three)
(C) M6 lock washer (18)
(D) M6 x 20 mm hex bolt (six)
(E) Drive arm (three)
(F) M6 square nut (nine)
(G) Interlock assembly (three)
(H) Grease tube (one)
(I) M6 fender washer (nine)
(J) Mounting plate (three)

Figure 1. Contents of Kits 2A11857G04/G08
Kit 2 (shown in Figure 2): Interconnecting kit, includes cables.
(K) Cable bracket (two)
(L) M6 lock washer (four)
(M) M6 x 10 mm thread-forming screws (four)
(N) Cable assembly (two) (in 5-, 6-, 8-, and 10-foot lengths)

Note: Three sets of cable kits (six cables) are required to connect three breakers so that only one of the three breakers can be closed at once. Closing any breaker holds the others tripped. Two sets of cable kits (four cables) connect three breakers so that two of three breakers can be opened or closed independently of each other. Closing either breaker will hold the third breaker tripped. Closing the third breaker will hold the other two breakers tripped.

Figure 2. Contents of Kits 2A11858G01–G04

Section 2: Installation of three-way cable interlock

Proceed with the following 11 steps:

Step 1: Remove the front cover by unscrewing the hex head captive bolts (four for three-pole, six for four-pole) that join the cover to the breaker housing using a 10 mm 1/4-inch drive socket. Then hold the charge handle down approximately 45 degrees to pull off the cover.

Figure 3. Step 1

Step 2: Remove the knockout from the right side of the front cover using pliers to break out the U-shaped tab. Carefully file any excess material from broken edge.

Figure 4. Step 2

Step 3: Install the drive arm (E) to the right end of the pole shaft with the drive arm lever extending downward as shown. Use an M6 x 25 mm flat-head screw (B) to make the connection and torque to 65–85 in-lbs (7.3–9.6 Nm).

Figure 5. Step 3

Step 4: Attach the interlock assemblies (G) and cable brackets (K) to the mounting plates (J). The interlock assembly is attached to the mounting plate using three M6 x 12 hex bolts (A) and lock washers (C). Torque to 40–50 in-lbs (4.5–5.6 Nm). Fasten the cable brackets to the mounting plates using two M6 x 10 thread-forming screws (M) and lock washers (L). Torque to 65–85 in-lbs (7–9 Nm).
Step 5: Attach the interlock assemblies from Step 5 to the right side of the breakers. Start by removing the M6 hex bolt, nut, lock washer and grounding (earthing) wire installed in the lower front corner of the mounting foot. This bolt assembly will be re-installed through the adapter plate near the end of this step.

Slide an M6 square nut (F) into the slot in the upper rear part of the case with the flat face toward the outside. The nut may have to be tapped to fully seat it into the slot. Install an M6 x 20 hex bolt (D), lock washer (C), and flat spacer washer (I) into the square nut a few turns. Locate another captive square nut in a slot in the upper part of the case, forward of the square nut just installed. Install another M6 x 20 hex bolt, lock washer, and spacer washer combination in this square nut. Slide the spacer washers fully against the case and the lock washers fully against the heads of the bolts. This creates a space into which the open slots in the top of the mounting plate will slide.

Now insert the mounting bracket slots onto the upper bolts and rotate the bracket down against the side of the breaker. Make sure that the drive paddle slides in behind the wireform tripper bar, and the follower arm slides in behind the drive arm pin.

Re-install the lower front bolt assembly (removed earlier), making sure to re-connect the ground (earth) wire. Torque to 65–85 in-lbs (7–9 Nm).

Check the interference of the lever assembly to the breaker to ensure flapper arm is behind tripper bar, and follower is BEHIND drive arm pin. If not, remove adapter plate and reinstall properly. Check clearances between end of drive arm and end of follower (1–4 mm). The tip of the pin on the end of the drive arm should protrude slightly beyond the follower. If this condition is not observed, it may be necessary to adjust the position of the mounting bracket relative to the breaker using upper spacer washers.

Step 6: Reinstall front cover removed in Step 1. Repeat Steps 1 through 6 for each breaker.
Step 7: At this point in the process, check the functioning of the lever assemblies of each breaker by performing the following checks in conjunction with provided graphics:

Check 1: With the breaker OPEN observe the position of the lower drive lever on each breaker. The gap between the lower right-hand corner of the drive lever and the mounting bracket flange should be from 0–2 mm (see Figure 8 Breaker OPEN). Now CLOSE the breaker. The drive lever should rotate 60 degrees counterclockwise. There should be a minimum gap of 1 mm and a maximum gap of 4 mm between the lower left-hand corner of the lever, and the mounting bracket flange (see Figure 8 Breaker CLOSED). If either of these gaps are out of specification, the installation should not continue. Consult Eaton for additional instructions.

Check 2: Now check the function of the upper driven lever and tripper bar on each breaker. With all breakers OPEN, the upper left-hand corner of the drive lever should be held in contact with the mounting bracket flange by the return spring, and the inner arm that operates the tripper bar should protrude a few millimeters beyond the right edge of the mounting bracket. With the breaker CLOSED, grasp and slowly rotate the drive (upper) lever counterclockwise. At approximately 30 degrees of rotation (with the lever approximately horizontal), the breaker should trip. If the breaker does not trip before the upper right-hand corner of the drive lever is within 3 mm of the mounting bracket flange (see Figure 8 Breaker OPEN), the driven lever and/or trip lever are out of specification. Do not continue the installation. Consult Eaton for additional instructions.

Step 8: This step describes how to route the cables. Before installing the cable, however, check to be sure that all cables move freely in their cable housing. Route the cables between cassettes in such a fashion that there are no sharp bends in the cable housing and the total number of bends are minimized. The minimum allowable cable housing bend radius is 4 inches (102 mm). After completing the installation and adjustment of the cables, attach the cable housing to the structure at a suitable number of points along the cable run, being careful not to compress the cable housing. The use of plastic wire clamps or wire ties will minimize the likelihood of binding the cables. After the cables are installed, recheck to be sure the cables still move freely. Refer to Table 1 and Figure 9 for installation details.

Table 1. Step 8 Cable Routing

<table>
<thead>
<tr>
<th>Type 33 (Six Cables)</th>
<th>Type 31 (Four Cables)</th>
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<tbody>
<tr>
<td>From Breaker/ Fitting</td>
<td>To Breaker/ Fitting</td>
</tr>
<tr>
<td>1A</td>
<td>3D</td>
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<tr>
<td>1C</td>
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<td>3A</td>
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Figure 8. Step 7

Figure 9. Step 8
**Step 9:** This step describes how to attach the cables to the interlock assembly. The attachment of the driven (long rod) end of the cable is illustrated. Remove the nut and spacer tube from the end of the rod. Slide the rubber boot toward the tip of the rod. Unthread the outer bulkhead nut and slide the nut and lock washer toward the tip. Insert the threaded end of the rod into the swivel fitting while simultaneously sliding the smaller diameter portion of the bulkhead fitting into the slot in the mounting plate. Raise the cable assembly until the threaded portion of the bulkhead fitting enters the slotted hole and fasten the bulkhead washer and nut finger tight. Adjust the two bulkhead nuts so that the fitting is approximately centered on the cable mounting bracket and hand tighten the nuts. Slide the rubber boot back into place over the end of the bulkhead fitting. Replace the tube spacer and upper nut on the rod end. The lower nuts should be shouldered against the end of the thread and the upper nut tightened against the spacer tube. While holding the lower nuts, torque to 30–40 in-lbs (3.3–4.5 Nm). Repeat the above process in this step to attach the other end of the cables to the other breaker interlock assembly. See Figure 9 for number and mounting position of cables.

The only difference is that the drive (short) rod uses a compression spring. Locate compression spring for Position A below the swivel fitting. The compression spring for Position C must be located above the swivel fitting (see Figure 9). The spring for Position C must therefore be removed before installation and replaced as shown before installation of the upper rod nut.

**Note:** Hold the cable rod with pliers while removing and installing the nuts to prevent the cable from rotating.

**Step 10:** This step describes how to adjust the cables. Adjustment of the cable is done with the bulkhead mounting nuts. The nuts on the rod ends should not be moved. The adjustment is performed with all three breakers OPEN. Begin by adjusting all cable bulkhead mounting nuts (both ends) so that the mounting bracket is approximately in the center of the threaded section of the bulkhead fitting. This allows room for adjustment in either direction. Finger tighten all bulkhead nuts in this position. Perform initial adjustments on the drive (long rod) end of the cable. There should be a small (0–0.5 mm) clearance between the rod nut and the face of the swivel on which it pushes or pulls. If there is too much or too little clearance, adjust both bulkhead nuts to move the cable housing. If additional adjustment length is required, the bulkhead nuts on the other end of the cable can also be used. When the proper clearance is attained on the driven end, tighten the cable bulkhead nuts on both ends to a torque of 100–120 in-lbs (11–13 Nm).

![Figure 10. Step 9](image)

![Figure 11. Step 10](image)
Step 11: The final step is to test the interlock assembly to verify that it conforms to all states in Table 2. All breakers must be OPEN and DISCHARGED.

1. To test a six-cable interlock assembly (Type 33):
   a. CHARGE and CLOSE Breaker A. Breakers B and C should be held in the OPEN condition. Inspect the driven lever on Breakers B and C. They should be rotated against its stop (the mounting bracket). CHARGE Breakers B and C and attempt to CLOSE them. They should not respond to the CLOSE attempt (no noise, no spring discharge, no contact motion). If the breaker does not respond as described, review Steps 3 through 11.
   b. OPEN Breaker A. The interlock should release. Close Breaker B. Verify that it closes with the OPEN/CLOSED indicator. Breakers A and C should now be held in the OPEN condition. Repeat the above checks on Breakers A and C (lever position, attempt to CLOSE).
   c. OPEN Breaker B. The interlock should release. Close Breaker C. Verify that Breaker A remains CLOSED. Again verify that Breaker B will not respond to a CLOSE attempt.

2. To test a four-cable interlock assembly (Type 31):
   a. CLOSE Breaker A. Breaker B should be held in the OPEN condition. Attempt to CLOSE Breaker B and verify that it does not respond to the CLOSE attempt (no noise, no spring discharge, no contact motion).
   b. CLOSE Breaker C. Verify that Breaker A remains CLOSED. Again verify that Breaker B will not respond to a CLOSE attempt.
   c. OPEN Breaker A. Verify again that Breaker B will not respond to a CLOSE attempt.
   d. OPEN Breaker C—all breakers now OPEN—CLOSE Breaker B. Verify that both Breakers A and C will not respond to a CLOSE attempt.

Table 2: Step 11 Logic

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<tr>
<th>Type 33 (Six Cable)</th>
<th>Type 31 (Four Cable)</th>
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